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Certificate
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RECD 06 JUN 2003

the documents annexed hereto are true copies of:

Application forms P.1 and P.2, provisional specification and drawings of South African Patent Application No. 2001/5470 as originally filed in the Republic of South Africa on 3 July 2001 and post-dated to 3 January 2002 in the name of NXCO INTERNATIONAL LIMITED for an invention entitled: "ACTIVATED SELF STEMMING CARTRIDGE".

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) or (b)

Geteken te PRETORIA in die Republiek van Suid-Afrika, hierdie 15th dag van May 2003
Signed at PRETORIA in the Republic of South Africa, this 15th day of May 2003

Registrateur van Patente
Registrar of Patents

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FORM P2
M R & F Ref: P.19164/Case 14

REPUBLIC OF SOUTH AFRICA

PATENTS ACT, 1978

Post. dated

REGISTRAR OF PATENTS

Official Application No.	Lodging date: Provisional	Acceptance date:
21 01 20015470	22 ~~3 JULY 2001~~ 3.1.2002	47
International classification	**Lodging date: Complete**	**Granted date:**
51	23	

Full name(s) of applicant(s)/Patentee(s)

71 NXCO INTERNATIONAL LIMITED

Applicant(s) substituted:	Date Registered:
71	

Assignee(s):	Date Registered:
71	

Full name(s) of inventor(s)

72 To be advised

Priority claimed	Country		Number		Date	
Note:	33	NONE	31	NONE	32	NONE
Use International	33		31		32	
Abbreviation for Country	33		31		32	

Title of Invention:

54 ACTIVATED SELF STEMMING CARTRIDGE

Address of applicant(s)/patentee(s)

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Patent of Addition No.	Date of any change:	
61		
Fresh Application based on:	**Date of any change:**	

McCALLUM, RADEMEYER & FREIMOND
Ref: P19164/Case 14

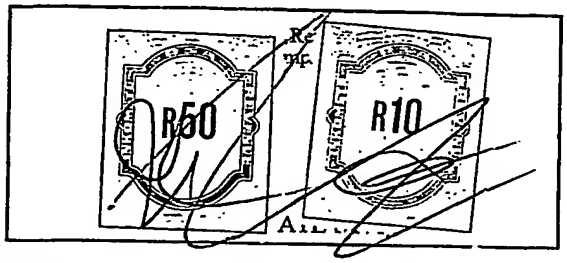
FORM P1

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

APPLICATION FOR A PATENT AND ACKNOWLEDGEMENT OF RECEIPT

(Section 30(1) - Regulation 22)

The grant of a patent is hereby requested by the undermentioned applicant on the basis of the present application filed in duplicate



OFFICIAL APPLICATION NO.

21	01	20015470

FULL NAME(S) OF APPLICANT(S)

71	NXCO INTERNATIONAL LIMITED

ADDRESS(ES) OF APPLICANT(S)

Saffrey Square, Suite 205, Bank Lane, Nassau, Bahamas

TITLE OF INVENTION

54	ACTIVATED SELF STEMMING CARTRIDGE

Priority is claimed as set out on the accompanying Form P2.
The earliest priority claimed is :

This application is a patent of addition to Patent Application No.	21	01	

This application is a fresh application in terms of section 37 and based on Application No.	21	01	

THIS APPLICATION IS ACCOMPANIED BY:

X	1	A single copy of a provisional specification of 8 pages
	2	Two copies of a complete specification of ..... pages
X	3	2 . sheets of Informal Drawings
	4	..... sheets of Formal Drawings
	5	Publication particulars and abstract (Form P8 in duplicate)
	6	A copy of Figure ..... of drawings (if any) for the abstract
	7	Assignment of Invention
	8	Certified priority document(s) Number(s)
	9	Translation of priority document(s)
	10	An assignment of priority rights
	11	A copy of the Form P2 and the specification of SA Patent Application No. 21 01
	12	A declaration and power of attorney on Form P3
	13	Request for ante-dating on Form P4
	14	Request for classification on Form P9
X	15	Form P2 in duplicate

74	ADDRESS FOR SERVICE: McCALLUM, RADEMEYER & FREIMOND, Maclyn House, June Avenue, Bordeaux P.O. Box 1130, Randburg, 2125

Dated this 3rd day of July 2001.

McCALLUM, RADEMEYER & FREIMOND
PATENT AGENTS FOR APPLICANT(S)

REGISTRAR OF THE COURT OF THE COMMISSIONER OF PATENTS
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3.1.2002 Post
2001 07 03 dated

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P.19164/Case 14

FORM P6

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

PROVISIONAL SPECIFICATION

(Section 30(1) - Regulation 27)

OFFICIAL APPLICATION NO			LODGING DATE Post-dated	
21	01	20015470	22	3.1.2002 3 ~~JULY~~ 2001

FULL NAME(S) OF APPLICANT(S)

71	NXCO INTERNATIONAL LIMITED

FULL NAME(S) OF INVENTOR(S)

72	To be advised

TITLE OF INVENTION

54	ACTIVATED SELF STEMMING CARTRIDGE

BACKGROUND OF THE INVENTION

This invention is concerned generally with the breaking of rock and more particularly is concerned with a stemming method to confine expansive forces which are generated in a hole by ignition of a propellant eg. using a customized low energy method of breaking rock in a controlled manner.

As used herein the word "rock" includes rock, ore, coal, concrete and any similar hard mass, whether above or underground which is difficult to break or fracture. It is to be understood that "rock" is to be interpreted broadly.

A number of techniques have been developed for the breaking of rock using non-explosive means. These include a carbon dioxide gas pressurisation method (referred to as the Cardox method), the use of gas injectors (the Sunburst technique), hydrofracturing and various methods by which cartridges containing energetic substances pressurise the walls or base of a sealed drill hole to produce penetrating cone fractures (known as PCF).

These techniques may be an order of magnitude more efficient than conventional blasting in that they require approximately 1/10 of the energy to break a given amount of rock compared to conventional blasting using high explosives. The lower energy reduces the resulting quantity of fly rock and air blast and to an extent allows the rockbreaking operation to proceed on a continuous basis as opposed to the batch-type situation, which prevails with conventional blasting.

Most non-explosive rockbreaking techniques rely on the generation of high gas pressures to initiate a tensile fracture at the bottom of a relatively short drill hole. If the force which is generated by the high gas pressure can be optimally used then the efficiency with which rock is broken is increased.

It is customary to make use of stemming to contain the forces which are generated when a propellant is initiated in a hole. These forces can be substantial and there may be a tendency for the stemming to move in the hole to a significant extent. When this happens the pressure which is generated by the propellant is reduced with the result that the force which is generated by the propellant is also reduced, a factor which results in less efficient rock fracture.

As used herein "propellant" is to be interpreted broadly to include a propellant, blasting agent, explosive, gas-evolving substance or similar means which, once initiated, generates high pressure material typically at least partly in gaseous form. Propellants of this nature are known in the art. Propellant and blasting agent are used interchangeably.

SUMMARY OF INVENTION

The invention provides a method of stemming which includes the steps of placing stemming material in a hole over a cartridge which contains a first propellant, and directing a gas generated force onto the stemming to counteract an oppositely directed force exerted on the stemming by the first propellant.

The gas generated force may be produced by a second propellant charge which may be ignited at a predetermined time relatively to the time at which the first propellant is initiated. The second propellant charge and the first propellant may be initiated substantially simultaneously or within a predetermined period of the initiation of the first propellant. The method may include the step of precisely controlling this predetermined period.

The method may include the step of placing stemming material over the propellant charges in the hole prior to ignition of the propellant charges.

A confinement member may be placed over the propellant charge and the said additional stemming may be placed over the confinement member.

The invention also provides stemming apparatus which includes a member, a propellant charge and an initiator for igniting the propellant charge, the member being shaped to provide a reaction surface or force against which force, which is exerted by the propellant charge, is applied.

The member may be of any appropriate shape and may include a recessed formation which contains the propellant charge.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is further described by way of example with reference to the accompanying drawings in which:

Figure 1 is a side view in cross-section illustrating the use of stemming apparatus according to the invention during a rock breaking process, and

Figure 2 is a schematic illustration of a control mechanism used for controlling, on a time basis, a rock breaking process.

DESCRIPTION OF PREFERRED EMBODIMENT

The accompanying drawings illustrate the implementation of a stemming method, according to the invention, during a rock breaking process.

Figure 1 illustrates a hole 10 which is drilled into a rock mass 12 from a face 14 using conventional drilling equipment, not shown. The hole is drilled to a length which is at least four times the nominal diameter of the hole.

A cartridge 16 is placed into the hole. The cartridge has a base 18 and a generally cylindrical wall 20 which extends upwards from the base and which, at an end which is remote from the base has a rounded shape 22.

The cartridge forms an enclosure for a propellant material 24 which is of known composition and which is loaded into the cartridge under factory conditions using techniques which are known in the art. An initiator 26 is loaded into the cartridge, preferably on site. Control wires 28 lead from the initiator to a control unit 30 which is located at a remote and safe position.

Stemming 32 is placed into the hole from the rock face 14 and covers the cartridge to a desired extent. The stemming is consolidated by being tamped in position.

In this example of the invention the base 18 of the cartridge is in close contact with a bottom 34 of the hole. The intention in this regard is that the stemming

should confine the cartridge on one side while the surrounding surface of the rock 12 should confine the cartridge on its remaining sides.

A shaped member 40 is placed in the hole over the stemming 32. The member is made from a plastics material and includes a downwardly facing recessed formation 42 which, in this example, is substantially conical. A propellant charge 44 is loaded into the formation 42 preferably under factory conditions. An initiator 46 is engaged with the member 40 and control wires 48 lead from the initiator to the control unit 30. Preferably additional stemming 50 is placed into the hole over the member 40 and is consolidated by being tamped downwardly.

Ignition of the propellant 24 by the initiator 26 causes the release of high pressure jet material which is substantially in gaseous form. The cartridge 16 is designed to contain the expanding high pressure material and for this reason is allowed to deform outwardly, without rupturing, so that the wall 20 of the cartridge is forced into close contact with an opposing surface of the wall of the hole. The cartridge does not fracture during this process for it is fabricated from a plastically deformable material.

The function of the cartridge, in this respect, is to confine the high pressure gas for a limited period. The function of the stemming on the other hand is to contain, to the maximum extent possible, the high pressure jet material which is released when the cartridge fractures. The force which is generated by the high pressure jet material and which is applied to the stemming 32 is substantial and can cause the stemming 32 to be displaced to a significant

extent in the hole 10. If movement of the stemming can be restricted then the pressure which is generated in the cartridge 24 can be contained so that the resulting force exerted by the high pressure jet material is increased.

In order to counteract the shock wave which is exerted on the stemming 32 by the combusting propellant 24 the propellant 44 is ignited at a precisely determined time relatively to the time at which the propellant 24 is ignited. This is done by applying a suitable control signal, generated by the control unit 30, through the control wires 48 to the initiator 46.

The deflagrating propellant 44 directs a shock wave into the stemming 32 which is timed and which is of a magnitude such that this shock wave counter-balances the shock wave which is exerted on the stemming by the propellant 24. The result is that the stemming 32 is effectively held stationary and maximum energy is extracted from the propellant 24 and applied to the surrounding rock 12 in order to crack the rock in an effective manner.

The member 40 helps to direct the shock wave generated by the propellant 44 into the stemming 32 and the stemming 50, in turn, helps to confine the member.

It is apparent that if the shock waves produced by the propellant 24 on the one hand and by the propellant charge 44 on the other hand, are to be balanced, that it is important for the shock waves to be essentially of the same magnitude, taking into account the resistive forces which are exerted by the stemming, and for the shock waves to be generated at precisely controlled

intervals. The control mechanism shown in Figure 2 is intended to provide the timing function to achieve this balancing effect.

The control mechanism, designated 60, is connected to the control unit 30 shown in Figure 1 by means of the control leads 28 and 48. The control mechanism includes a capacitor 62 which is charged, beforehand, by means of a suitable charging voltage which is applied via the leads 48 to the capacitor. The mechanism further includes a timer 64 which is turned on, to start a timing interval of a predetermined duration, by means of a control signal applied via the wires 48 from the control unit. At the end of the timing interval a switch 66 in the timer is closed and the capacitor is caused to discharge through the closed switch and direct the discharged energy into the initiator 46 which is associated with the propellant 42. The control signal which is used to start the timer can also be used to fire the initiator 26. In this arrangement it is apparent that the ignitor 46 will be fired a short interval after the initiator 26 is fired. It is possible however to reverse the sequence of operations in that the ignitor can be ignited before the initiator 26. The sequence of operations in this regard is determined by the aforementioned requirement in that, as noted, the two shock waves must be generated in such a way that they effectively meet and counteract each other within the mass of the stemming 32.

Dated this 3rd day of July 2001.

McCALLUM, RADEMEYER & FREIMOND
Patent Agents for the Applicant

FIG 1

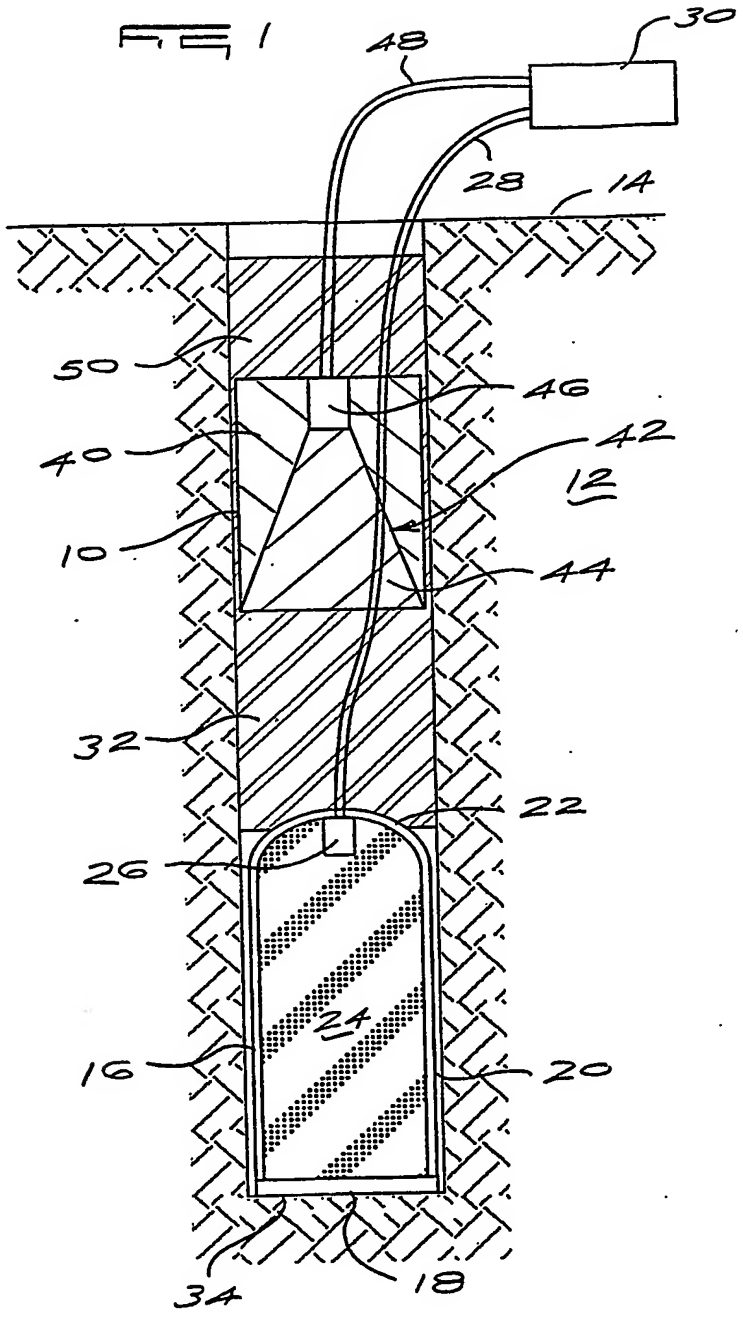

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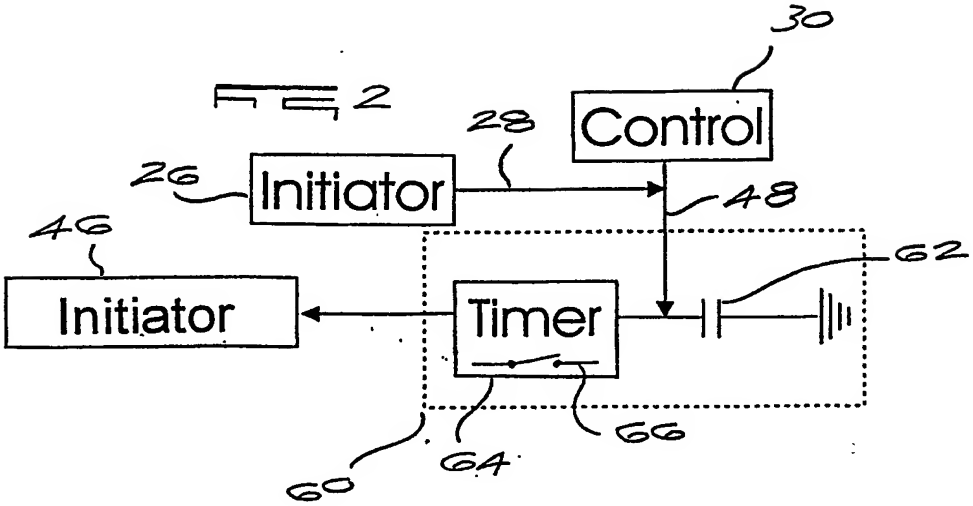
FIG 2



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